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August 16, 2004

Mr. Nabil S. Fayoumi
U. S. EPA - Region 5
77 West Jackson Boulevard (SR-6J)
Chicago, Illinois 60604-3590

Re: Summary Report with Proposed Locations for Soil Borings / Piezometers
Sauget Area 1

Overnight Mail

Dear Nabil:

Attached please find the above referenced report. This document is also being sent by overnight mail to the list of individuals below.

As previously discussed, our meeting to finalize agreement on the placement of these additional eighteen borings will be held at the Site R Trailer (in Sauget) on August 24th, 2004. The meeting will begin at 1:00 pm, Central Time.

For those of you participating by phone, the dial in number is 805-240-9843 and the participation code is 229528.

If you have any questions, please call.

Sincerely,

Steven D. Smith
Project Coordinator

CC:	Sandra Bron (2 copies) -	Illinois EPA
	Walter Weinig -	Laramide Environmental
	Chris English (2 copies) -	CH2M Hill
	Richard Williams -	R. S. Williams & Associates

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SUMMARY REPORT WITH PROPOSED LOCATIONS FOR SOIL BORINGS/PIEZOMETERS

Sauget Area 1, Sauget and Cahokia, Illinois

1.0 INTRODUCTION

A characterization and remediation study is in progress to investigate DNAPL in the subsurface underlying the Sauget Area 1 Sites in Sauget, Illinois. The study focuses on Sauget Area 1 Sites G, H, I, and L, and is being conducted in accordance with the DNAPL Work Plan previously submitted to the USEPA (GSI, 2004a). To date, the completed work activities have included i) an initial survey for LNAPL and/or DNAPL at existing wells and piezometers conducted in May 2004; and ii) a 3-D seismic reflection survey to map the topography of the underlying bedrock surface. Preliminary results of the seismic reflection survey were received on August 11, 2004. Soil sampling and piezometer installation are scheduled to begin in early September 2004.

This summary report has been developed to identify suitable locations for the soil borings and piezometers. The report includes discussion of the following topics:

- Conceptual model for DNAPL distribution.
- Results of May 2004 LNAPL and DNAPL survey at Sauget Area 1.
- Bedrock surface elevation map for the W. G. Krummrich Facility.
- Preliminary bedrock surface elevation map for Sites G, H, I, and L.
- Summary of NAPL observations and interpretations of NAPL extent at Sauget Area 1
- Potential for residual and/or free phase DNAPL based on groundwater analytical data.
- Proposed locations for soil borings and piezometers and rationale for proposed locations.

2.0 CONCEPTUAL SITE MODEL

Section 2.0 of the DNAPL Work Plan (GSI, 2004a) presented a Conceptual Site Model for DNAPL at Sauget Area 1. In this Conceptual Site Model, DNAPL distribution at Sauget Area 1 is described as follows:

- Pooled DNAPL is or may be present in Sites G, H, I and/or L;
- DNAPL is or may be present as small, discreet blobs and/or ganglia in the unsaturated zone;
- DNAPL is or may be present as small, discreet blobs and/or ganglia in the saturated zone;
- Dissolved DNAPL is or may be present in the aquifer beneath and downgradient of Sites G, H, I and/or L; and
- Pooled DNAPL is or may be present at the alluvial aquifer/bedrock interface beneath or downslope of Sites G, H, I and/or L.

The Conceptual Site Model (see Section 2.0 of DNAPL Work Plan) also included discussion regarding the area and volume of the DNAPL-containing materials, human health and environmental protection, plume migration projections, particle-track modeling, and time-to-clean estimates to reach ARARs.

Based on the Conceptual Site Model, the DNAPL Characterization and Remediation Study is focused on collecting the information needed for i) estimation of the volume of DNAPL-affected material; ii) assessment of the ability to remove residual DNAPL from the aquifer matrix by treatment; iii) estimation of the removal efficiencies of various treatment technologies; and iv) determination of the presence of pooled DNAPL. These data will be used to determine if aggressive source treatment will make any meaningful difference in the time required to achieve ARARs and, if so, the cost of such treatment.

This summary report presents the current interpretation of NAPL occurrence at Sauget Area 1, along with proposed locations for soil borings/piezometers. However, this report does not change the Conceptual Site Model presented in the DNAPL Work Plan.

3.0 RESULTS OF MAY 2004 NAPL SURVEY

The NAPL survey conducted by GSI in May 2004 included 57 wells and piezometers at Sauget Area 1 (Figure 1). The survey was conducted in accordance with the procedures outlined in Task 2 of the Work Plan (GSI, 2004a), and oversight was provided by CH2M Hill, a USEPA contractor.

NAPL Survey Procedures: At each well or piezometer, the survey included measurement of the depth to water and a check for the presence and thickness of free phase LNAPL and DNAPL using an electronic interface probe. A disposable clear bailer was lowered to the water level in each well to check for the possible presence of free phase LNAPL. A visual check for free phase DNAPL was performed by lowering a weighted cotton string to the bottom of the well, then retrieving the string to inspect for evidence of staining. Finally a disposable clear bailer was lowered to the bottom of each well to check for the presence of free phase DNAPL. New string, bailer, and bailer cord were used for each well, and soiled string, bailers, and cord generated during the survey were placed in a designated container for management as investigation-derived waste.

NAPL Survey Results: One well (EE-11) was found to have recoverable free phase LNAPL. Two bedrock wells (BR-G and BR-I) showed some evidence of the presence of a small amount of free phase DNAPL, but no free phase DNAPL could be recovered from either well.

Well EE-11 contained a dark brown LNAPL that appeared to be a petroleum substance, based on color and odor. The well contained as much as 8 to 9 feet of LNAPL. A total of approximately one gallon of LNAPL was removed from EE-11 during a recovery test conducted on May 19, 2004. Well EE-11 is low yield well and became dry after only a relatively short period of pumping. Fluid levels in EE-11 were re-measured on May 20, 2004, and at that time

EE-11 had a layer of LNAPL approximately 0.2 feet thick. A total of approximately 1/4 cup of LNAPL (0.02 gallons) was removed from EE-11 during the recovery test conducted that day. A sample of LNAPL recovered from EE-11 was retained for chemical analysis and physical properties testing.

Bedrock well BR-G had some evidence of the presence of a small amount of DNAPL. Dark brown spots and minor discontinuous brown staining were noted on the bottom 4 feet of a weighted cotton string lowered to the bottom of BR-G. A bailer lowered to the bottom of BR-G was found to have a light sheen or droplets on the bailer surface when it was retrieved, but no free phase DNAPL was present within the bailer. A DNAPL recovery test was attempted at this location on May 20, 2004, and approximately 5 gallons of fluids were pumped from the bottom of the well using a Waterra inertial lift pump. Only water was recovered; no free phase DNAPL or DNAPL droplets were visible in the produced fluids.

Bedrock well BR-I also had some evidence of the presence of DNAPL. Dark brown spots and minor discontinuous brown staining were noted on the bottom 9 feet of a weighted cotton string lowered to the bottom of BR-I. A bailer lowered to the bottom of BR-I was found to have brown staining on the bailer surface when it was retrieved, and approximately 1/8 inch of DNAPL was observed in the bottom of the bailer. A DNAPL recovery test was attempted at this location on May 204, 2004, and approximately 8 gallons of fluids were pumped from the bottom of the well using a Waterra inertial lift pump. Only water was recovered; no free phase DNAPL or DNAPL droplets were visible in the produced fluids.

4.0 BEDROCK SURFACE ELEVATION MAP FOR W. G. KRUMMRICH FACILITY

A topographic map of the bedrock surface was developed in May 2004 as part of a DNAPL investigation at the W. G. Krummrich Facility, which is located immediately north of Site I. The topographic map (see Figure 2) was developed following acquisition and interpretation of five 2–D seismic reflection lines. The topographic map was constructed by the seismic survey contractor using a contouring program and the following data sources: i) five seismic reflection lines; ii) bedrock depths from piezometers installed during the DNAPL investigation at the W.G. Krummrich Facility; iii) estimated bedrock depths at certain monitoring wells at the W. G. Krummrich Facility; iv) bedrock depths from borings at and near the barrier wall at Site R in Sauget Area 2; v) bedrock depths from monitoring wells BR-G, BR–H, and BR-I at Sauget Area 1; and vi) bedrock depths from two monitoring wells located approximately 1100 feet east of Site I. The seismic reflection lines and all other depth control points are shown Figure 2.

The topographic map shows bedrock surface elevation in feet above mean sea level (MSL) and is contoured using a 2.5-ft interval. Blue colors represent lower bedrock surface elevations, as indicated by the color bar in the legend. The outlines of Sauget Area 1 Sites G, H, and I are visible in the south-central part of the map. Bedrock surface elevations range from approximately 290 feet to 315 feet above MSL in the area comprising the W. G. Krummrich Facility and Sites G, H, and I. Bedrock surface elevations range from approximately 280 to 287 feet above MSL near the barrier wall at Site R.

On Figure 2, the bedrock surface contours for the area at and near Sites G, H, and I are based on interpretation from a limited number of control points. This figure depicts an initial generalized interpretation of the bedrock surface at Sauget Area 1.

5.0 PRELIMINARY BEDROCK SURFACE ELEVATION MAP FOR SITES G, H, I, and L

A preliminary topographic map of the bedrock surface has been constructed for the area at and near Sites G, H, I, and L based on results of a 3-D seismic reflection survey. A geophysical survey contractor conducted the seismic reflection survey from June 7-30, 2004. To complete the seismic reflection survey in an expedited manner, the contractor worked 23 days and took only one day off during this field program.

At the start of the field program, a land survey was conducted using GPS to establish the geophone positions for the seismic survey grid. The seismic survey was conducted using a network of geophones and cables, a data acquisition and recording instrument, and an energy source. At most locations in the study area, the energy source was a truck-mounted accelerated weight drop apparatus. At locations where truck access was not possible, a 20-lb sledgehammer was used as the energy source. Downhole "check shot" surveys were conducted in bedrock wells BR-G, BR-H, and BR-I to generate seismic travel time to depth relationships.

Data processing and analysis began after data acquisition had been completed. The seismic reflection data were processed in various stages using a UNIX workstation and seismic processing software. The geophysical contractor conducted the processing and interpretation on an accelerated schedule, to meet project requirements. Processing and preliminary interpretation were finished on August 11, 2004, at which time the geophysicist issued a preliminary bedrock surface elevation map for the study area (see Figure 3). This map was constructed by the geophysicist using a contouring program and the following data sources: i) the 3-D seismic reflection data; and ii) bedrock depths from monitoring wells BR-G, BR-H, and BR-I.

The topographic map shows bedrock surface elevation in feet above MSL. Blue colors represent lower bedrock surface elevations, as indicated by the color bar in the legend. According to this preliminary map, estimated bedrock surface elevations within the study area range from approximately 270 feet to 315 feet above MSL.

The geophysicist has emphasized that this map should be considered preliminary, especially for Site G. Some additional processing work remains to be completed for Site G, and bedrock surface elevations in that area are subject to change. The accuracy of Figure 3 can be improved by incorporating bedrock depth information obtained during the upcoming soil boring and piezometer installation field program.

6.0 OCCURRENCE OF RESIDUAL AND FREE PHASE NAPL AT SAUGET AREA 1

6.1 Observations and Interpretations Regarding NAPL

The following paragraphs summarize historical and recent observations of NAPL in wells and piezometers and briefly outline previous interpretations of NAPL occurrence at Sauget Area 1.

Observations During NAPL Survey, September 1999: A NAPL survey was conducted at all existing wells and piezometers as part of a site investigation at Sauget Area 1. Measurements and observations were recorded in field notes (O'Brien & Gere Engineers, 2000). Pooled DNAPL was reported to be present in 33 wells and piezometers based on downhole measurements using an interface probe. Well EE-11 was the only location for which a visual observation of free product was recorded in the field notes. There were no indications of NAPL on the interface probe except at EE-11.

Observations During Sampling of Bedrock Wells, April 2000: Three bedrock wells were installed, one each at Sites G, H, and I. DNAPL was noted in April 2000 during sampling of monitoring well BR-I (Roux Associates, 2001). The potential presence of DNAPL was noted during sampling at well BR-G, but not at well BR-H.

Interpretation of NAPL Occurrence, June 2001: The Sauget Area 1 Engineering Evaluation/Cost Analysis and Remedial Investigation/Feasibility Study (the EE/CA and RI/FS report) discussed the potential for DNAPL occurrence at Sauget Area 1 based on analysis of several indicators (Roux Associates, 2001). The indicators included increasing COC concentrations with depth, presence of COCs deep in the alluvial aquifer, and presence of some COCs at concentrations in excess of 1% of the pure-phase solubility. Based on this information, the conceptual model for DNAPLs at that time was described as follows:

> *It is expected that much of the DNAPL mass at Sauget Area 1 is trapped by capillary forces within the alluvial aquifer pore space as small, discrete blobs and ganglia. However, some free-phase DNAPL may have migrated to the bedrock surface, where it may be present in free-phase pools.*

This report also mentioned the observation of DNAPL at BR-I and possible presence of DNAPL at BR-G. The report did not discuss results of the September 1999 NAPL survey. It was believed that the September 1999 field notes were not reliable, based on the absence of free phase DNAPL during well development and groundwater sampling in October 1999.

Alternate Interpretation of NAPL Occurrence, September 2001: A contractor for the U.S. Army Corps of Engineers tabulated the field notes from the September 1999 NAPL survey and included this data as Table 4-0c in a separate EE/CA and RI/FS report for Sauget Area 1 (Adrian Brown, 2001). Based on Table 4-0c, this report suggested that free phase DNAPL was widespread at Sauget Area 1.

Development of DNAPL Work Plan, 2003: Based on a directive from USEPA, a Work Plan was prepared for investigation of DNAPL at Sauget Area 1 (GSI, 2004a). In response to agency comments, data from Table 4-0c were incorporated into the Work Plan, and scope of the Work Plan was refined based on the inferred presence of widespread free phase DNAPL at Sauget Area 1.

Observations During NAPL Survey, May 2004: As discussed in Section 3.0, a NAPL survey of 57 existing wells and piezometers was conducted by GSI in May 2004. The survey included downhole measurements using an interface probe and methods for direct observation of NAPL (i.e., clear bailers, weighted cotton string, and NAPL recovery tests). Free phase LNAPL was found at well EE-11. Some evidence of free phase DNAPL was observed at bedrock wells BR–G and BR-I. However, no free phase DNAPL was observed during DNAPL recovery tests at BR-G and BR-I.

GSI's Evaluation of NAPL Data, July 2004: Field notes from 1999-2000 and other site information were reviewed to evaluate the reliability of the DNAPL thickness data on Table 4-0c. Results of this evaluation are summarized below and presented in detail in a recent technical memorandum (GSI, 2004b).

6.2 Results of GSI's Evaluation of September 1999 NAPL Survey Data

In the September 1999 field notes, well EE-11 was the only location for which visual observations of free product were recorded in the notes. The field notes for EE-11 state the following: "Well has free product in it! Brown oily liquid." It is likely that the free product observed in EE-11 September 1999 was LNAPL, not DNAPL, on the basis of the specific gravity measurement of 0.89 for the NAPL sample collected from this well in May 2004.

The absence of visual observations of free product in the field notes except at well EE-11 suggests that the free phase DNAPL thickness values on Table 4-0c may not be reliable. As discussed in the GSI technical memorandum (GSI, 2004b), the following lines of evidence also suggest that the DNAPL thickness values are not reliable:

i) the absence of visual observations of free phase DNAPL in field notes from well development and sampling conducted in October 1999;
ii) the absence of low-permeability layers that could account for extensive pooling of free phase DNAPL in the shallow and middle hydrogeologic units of the alluvial aquifer;
iii) groundwater analytical results from certain wells that appear to be inconsistent with the reported presence of free phase DNAPL in those wells; and
iv) information regarding the nature of historical operations at Site N that is inconsistent with the reported presence of free phase DNAPL in piezometers near Site N.

Based on the documentation in the technical memorandum (GSI, 2004b), GSI believes that the only reliable data on Table 4–0c regarding NAPL occurrence is the visual observation of free product (now confirmed to be LNAPL) that was noted in well EE-11. There is no supporting evidence for the reported DNAPL thickness values for other wells and piezometers. As documented in the technical memorandum, the most likely explanation for the questionable

DNAPL measurements on Table 4-0c is that a defective interface probe was used during the survey. Contrary to what is suggested by the data on Table 4-0c, it is likely that free phase DNAPL was not widespread in 1999.

7.0 EVALUATION OF GROUNDWATER ANALYTICAL DATA

Groundwater analytical results can be a useful indicator of possible DNAPL occurrence. GSI conducted additional review of groundwater analytical results from 1999-2000 in the EE/CA and RI/FS report (Roux Associates, 2001) to identify potential locations for DNAPL occurrence at and near Sites G, H, I, and L. GSI also reviewed results of an investigation conducted in 2003 at Site L by a USEPA contractor (Tetra Tech, 2003).

7.1 Groundwater Analytical Results for Site I (1999-2000)

In 1999-2000, the highest concentrations of total VOCs and total SVOCs measured in groundwater at Sauget Area 1 were generally from samples collected at and near Site I. VOCs and SVOCs occurred within, beneath, and downgradient of Site I. Concentrations of chlorobenzene and 1,4-dichlorobenzene exceeded the Illinois Class I standards within the shallow, middle, and deep hydrogeologic units of the alluvial aquifer beneath the Site I fill area and downgradient of Site I (see Figures 4 through 7).

The concentrations of chlorobenzene and 1,4-dichlorobenzene exceeded 1% of the pure phase solubility at locations beneath the Site I fill area and to the west of Site I. The presence of COCs at concentrations in excess of 1% of the pure-phase solubility is an indicator for potential occurrence of residual and/or free phase DNAPL. The presence of elevated concentrations of chlorobenzene and 1,4-dichlorobenzene in groundwater to the west of Site I is probably due to dissolution of residual DNAPL within the aquifer matrix underlying the Site I fill area.

7.2 Groundwater Analytical Results for Sites G, H, and L (1999-2000)

VOCs and SVOCs were also detected in 1999-2000 in groundwater within, beneath, and downgradient of Sites G, H, and L. At locations beneath the fill areas for Sites G and H, concentrations of chlorobenzene and 1,4-dichlorobenzene exceeded the Illinois Class I standards within the shallow, middle, and deep hydrogeologic units of the alluvial aquifer (see Figures 4 through 7). Based on results from a single sample from 1999-2000, only low levels of these two constituents were detected in groundwater at Site L.

Concentrations of VOCs and SVOCs decreased dramatically downgradient from Site G, as indicated on the following tables.

SITES G, H, AND L: MAXIMUM DETECTED TOTAL VOC CONCENTRATION (1999-2000)				
	Sites G, H, and L Fill areas (ug/L)	Downgradient Profiling Locations (ug/L)		
		AA-GHL-S1 25 ft from Site G	AA-GHL-S1 275 ft from Site G	AA-GHL-S1 600 ft from Site G
Shallow Hydrogeologic Unit	19,153	13.5	3.5	ND
Middle Hydrogeologic Unit	145	270	131	8.8
Deep Hydrogeologic Unit	890	9.6	79	16
Alluvial Aquifer/Bedrock Interface or Deepest Alluvial Aquifer Sample	247 (at BR-G)	0.89 (107-111 ft)	1.4 (99-103 ft)	0.91 (110-114 ft)

SITES G, H, AND L: MAXIMUM DETECTED TOTAL SVOC CONCENTRATION (1999-2000)				
	Sites G, H, and L Fill areas (ug/L)	Downgradient Profiling Locations (ug/L)		
		AA-GHL-S1 25 ft from Site G	AA-GHL-S1 275 ft from Site G	AA-GHL-S1 600 ft from Site G
Shallow Hydrogeologic Unit	49,290	2.4	ND	0.8
Middle Hydrogeologic Unit	14,957	38	32	2.9
Deep Hydrogeologic Unit	3,013	38	11.3	4.5
Alluvial Aquifer/Bedrock Interface or Deepest Alluvial Aquifer Sample	10,468 (at BR-G)	38 (107-111 ft)	0.9 (99-103 ft)	1.0 (110-114 ft)

The concentrations of chlorobenzene and 1,4-dichlorobenzene exceeded 1% of the pure phase solubility at several sampling locations beneath the fill areas for Sites G and H (see Figures 4 through 7). However, there were no locations downgradient of Site G where the measured groundwater concentrations of chlorobenzene or 1,4-dichlorobenzene exceeded 1% of the pure phase solubility.

7.3 Groundwater Analytical Results for Site L (2003)

In March 2003, a USEPA contractor conducted trenching, waste sampling, soil sampling, and groundwater sampling at Site L to identify the presence of COCs. Twelve groundwater samples were collected within the shallow hydrogeologic unit of the alluvial aquifer. Sampling locations are shown on Figure 8. As shown on the table below, concentrations of chlorobenzene and dichlorobenzenes exceeded Illinois Class I standards in two groundwater samples (see B-1 and B-2 on Figure 8).

SITE L: CHLOROBENZENE AND DICHLOBENZENE CONCENTRATIONS (2003)				
	Illinois Class I GW Standards (ug/L)	Locations between Sites G and H (ug/L)		Other Locations Sampled (ug/L)
		SL-W-B1 (18-22 ft)	SL-W-B2 (18-22 ft)	Ten Locations (18-22 ft)
Chlorobenzene	100	200	430	1 (max.)
1-2-Diclorobenzene	600	870	11,000	17 (max.)
1,4-Dichlorobenzene	75	1,100	64	2 (max.)

Sampling locations B-1 and B-2 are to the north of the Site L fill area but are directly downgradient (i.e., west) of the Site H fill area. B-1 and B-2 are probably within the chlorobenzene and 1,4-dichlorobenzene plume boundaries that are shown on Figures 4 and 6. It is likely that shallow groundwater impacts detected at B-1 and B-2 are due to dissolution of constituents from within or beneath Site H.

The groundwater samples that were collected in closest proximity to the Site L fill area (see B-3, B-4, and B-5 on Figure 8) had no exceedances of Illinois Class I standards for any VOCs or SVOCs. Although these groundwater analytical results do not indicate potential presence of DNAPL at Site L, placement of a soil boring/piezometer location at the Site L fill area is justified, in order to better document subsurface conditions at this location.

8.0 PROPOSED SOIL SAMPLING/PIEZOMETER LOCATIONS

As discussed in Section 2.0, the Sauget Area 1 DNAPL Characterization and Remediation Study is focused on collecting the information needed for: i) estimation of the volume of DNAPL-affected material; ii) assessment of the ability to remove residual DNAPL from the aquifer matrix by treatment; iii) estimation of the removal efficiencies of various treatment technologies; and iv) determination of the presence of pooled DNAPL.

The goals for Task 4 of the DNAPL Work Plan (soil boring and piezometer installation) have been revised based on the evaluation provided above in Sections 3.0, 6.0, and 7.0. The new goals for Task 4 are: i) to characterize the nature and extent of residual and free phase DNAPL potentially present within the fill areas and within the shallow, middle, and deep hydrogeologic units underlying the fill areas; ii) to evaluate the potential presence of residual and/or free phase DNAPL to the west of Site I within the shallow, middle, and deep hydrogeologic units; iii) to investigate the potential presence of free phase DNAPL in topographic lows on the bedrock surface; and iv) to determine whether or not free phase LNAPL is present to the west at Site G within the shallow hydrogeologic unit.

In accordance with the DNAPL Work Plan, Task 4 will include a total of 18 drilling locations. Proposed locations are shown on Figure 9 and summarized below. The proposed locations will need to be field checked to confirm drill rig accessibility and the absence of above ground and underground obstructions and utilities.

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	Shallow Soil Boring Plus a Piezometer	Soil Boring to Bedrock Plus a Piezometer	Total No. of Drilling Locations
Site I Fill Area		5 (two south, two central, one north)	5
West of Site I		1 (near location AA-I-S1 on Fig. 4)	1
Site G Fill Area		3	3
West of Site G	1 (for LNAPL)		1
Site H Fill Area		3	3
West of Site H		1	1
Site L Fill Area		1	1
		"Tentative" Proposed Locations	3
		Total:	**18**

The proposed number of soil borings/piezometers for each fill area is based on the size of the fill area and the potential magnitude of DNAPL impact. Accordingly, more soil borings/piezometers are proposed for evaluation of Site I, compared with Site L, because Site I has a much larger surface area and may potentially have more significant DNAPL impacts. Site L does not appear to be a major DNAPL source, based on review of 1999-2000 groundwater data (Roux Associates, 2001) and results of the investigation conducted for USEPA (Tetra Tech, 2003).

As illustrated on Figure 9, many of the proposed borings/piezometers are located at suspected topographic lows in the bedrock surface. However, one location at the Site H fill area and two locations at the Site I fill area are not at suspected topographic lows. These locations were selected to provide an adequate horizontal distribution of borings/piezometers to characterize conditions within and beneath these fill areas.

One shallow soil boring/piezometer has been proposed for the area west of Site G to verify that the LNAPL detected at well EE-11 does not extend beyond the limits of the Site G fill area. Three locations are indicated as "tentative" on Figure 9. It is proposed that these tentative locations be finalized in consultation with USEPA at the project meeting scheduled for August 24, 2004.

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9.0 REFERENCES

Adrian Brown, 2001. Engineering Evaluation/Cost Analysis, Remedial Investigation/ Feasibility Study, Sauget Area 1, Volume 1, Revision 2, September 28, 2001.

Groundwater Services, Inc., 2004a. Workplan for DNAPL Characterization and Remediation Study, Sauget Area 1 Sites, Sauget, Illinois. April 1, 2004.

Groundwater Services, Inc., 2004b. Technical Memorandum – Evaluation of September 1999 DNAPL Thickness Data listed on Table 4-0c, Sauget Area 1, Sauget and Cahokia, Illinois, August 4, 2004.

O'Brien & Gere Engineers, 2000. Soil, Ground Water, Surface Water, Sediment, and Air Sampling Field Sampling Report, Sauget Area 1, Volumes 3 and 9, July 2000.

Roux Associates, 2001. Engineering Evaluation/Cost Analysis, Remedial Investigation/ Feasibility Study, Sauget Area 1, Revision 1, June 8, 2001.

Tetra Tech, 2003. Site Investigation Report, Sauget Site L, June 16, 2003.

GSI Job No. G-2876
Issued: August 13, 2004

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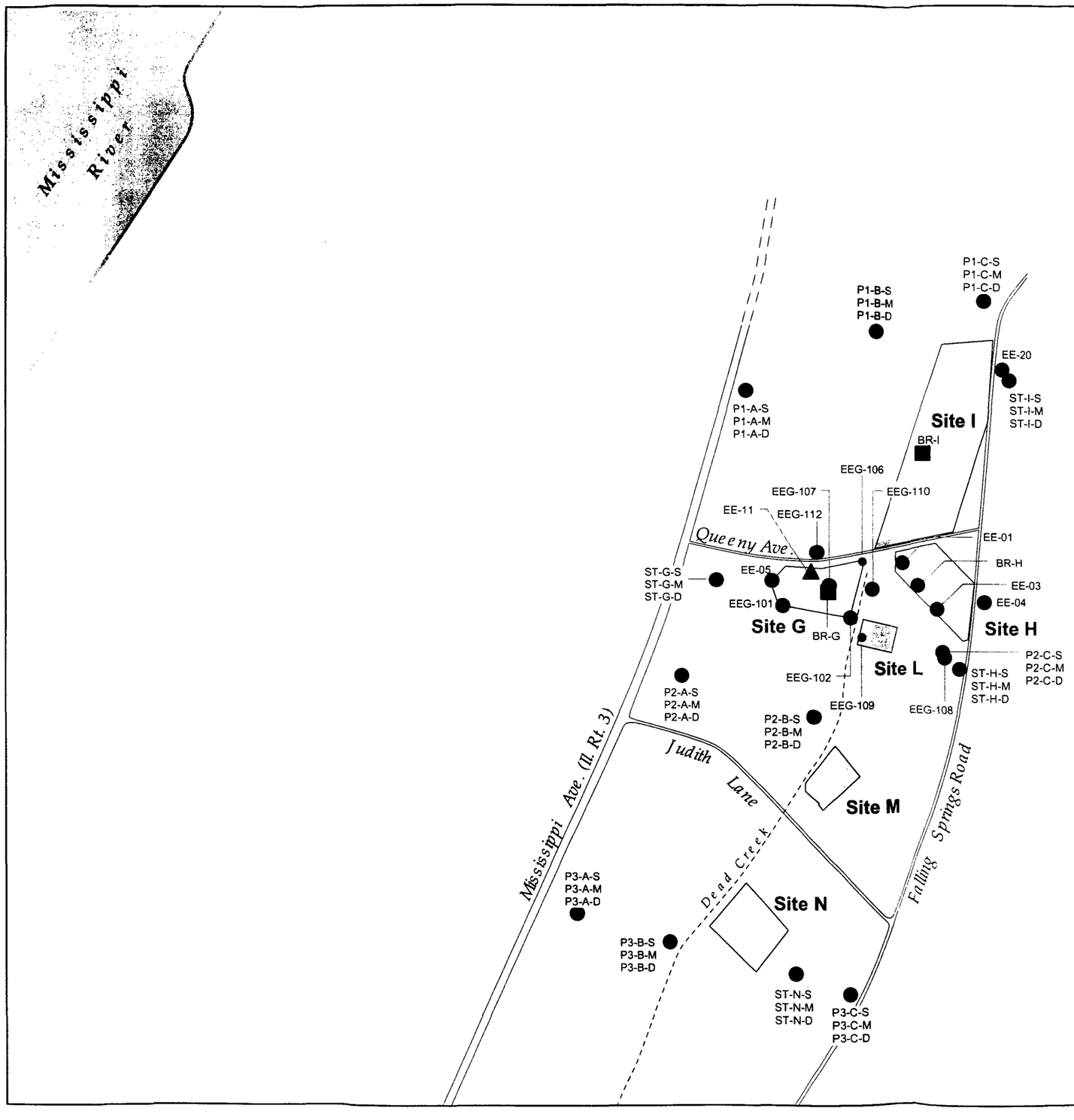
SUMMARY REPORT WITH PROPOSED LOCATIONS FOR SOIL BORINGS/PIEZOMETERS

DNAPL Characterization and Remediation Study
Sauget Area 1, Sauget and Cahokia, Illinois

FIGURES



N

LEGEND

- ● Existing monitoring well or piezometer location
- ▲ LNAPL or evidence of LNAPL was found during May 2004 survey.
- ■ DNAPL or evidence of DNAPL was found during May 2004 survey.
- ● No evidence of LNAPL or DNAPL was found during May 2004 survey.

Note: Wells EEG -106 and EEG -109 could not be measured due to bent well casing.

SCALE (ft.)

0 400 800

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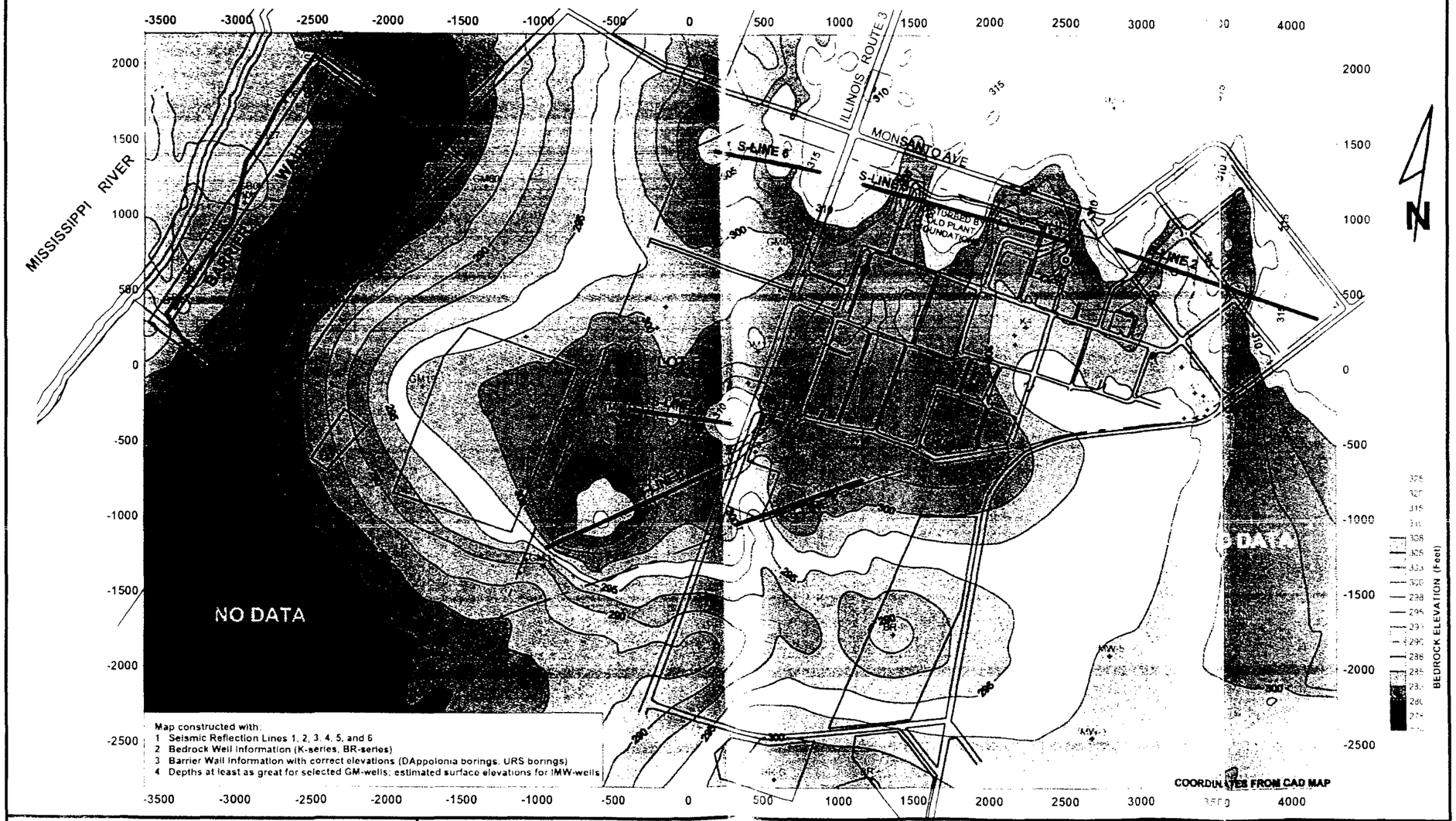
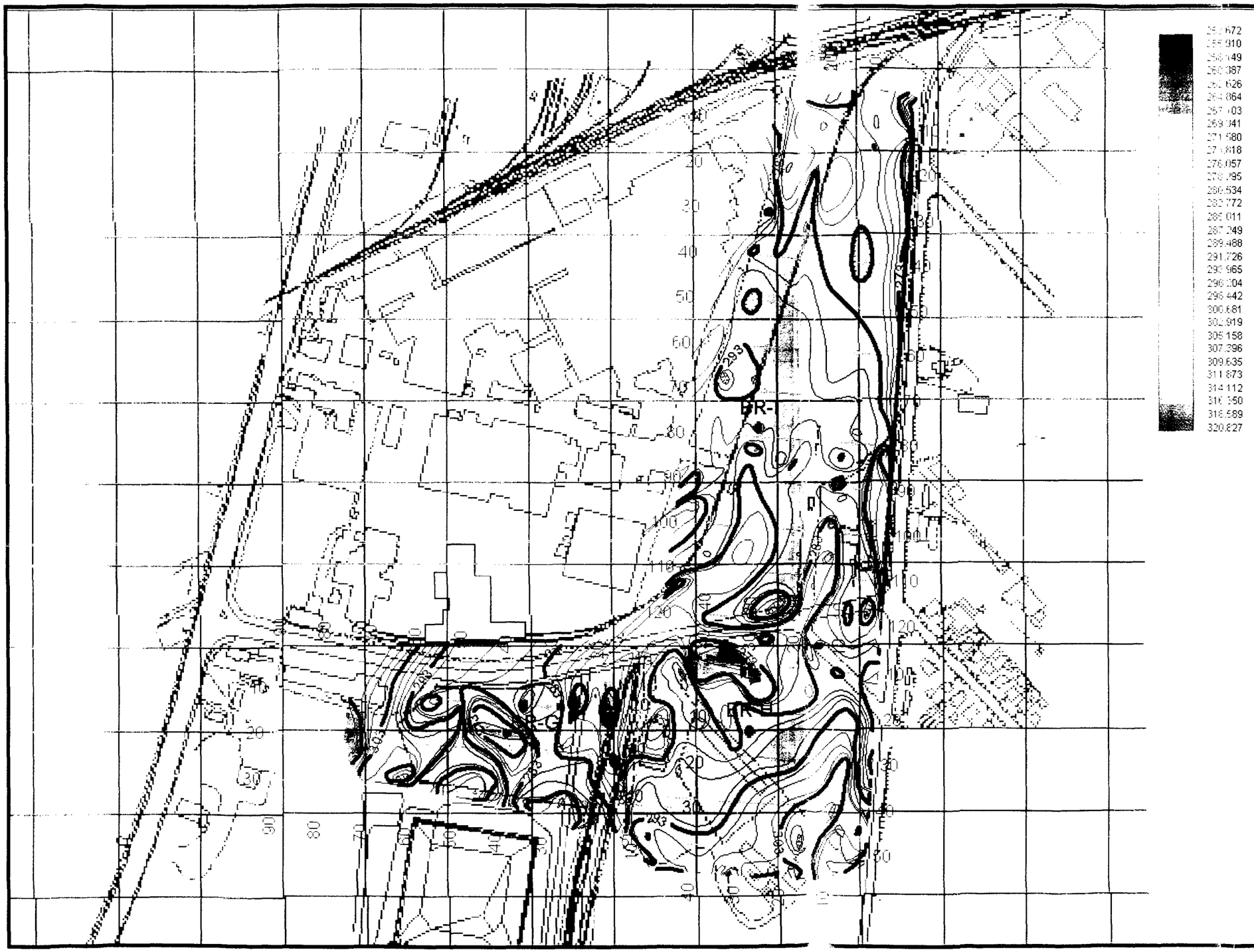
MAP SHOWING NAPL SURVEY RESULTS: MAY 2004

Sauget Area 1, Sauget and Cahokia, Illinois

GSI Job No.	G-2876	Drawn By:	TUH
Issued:	8/12/04	Chk'd By:	JAK
Revised:		Appv'd By:	
Scale	As Shown		**FIGURE 1**



BEDROCK SURVEY **SAUGET, ILLINOIS**	MAP SCALE (in Feet) 0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000 GEOSPHERE INC DRAFT 05-29-2004	**CONTOUR MAP OF** **BEDROCK SURFACE ELEVATION**
GROUNDWATER SERVICES, INC	**Map of Bedrock Surface at** **W. G. Krummrich Facility** Sauget and Cahokia, Illinois	GSI Job No G-2876 · Drawn By Issued 08 12 04 · Appv'd Scale As Shown · **FIGURE 2**



N

Notes:

1) This preliminary bedrock surface map was constructed by a geophysics contractor based on results of a 3-D seismic reflection survey. Seismic survey data was acquired June 7-30. 2004. This map was generated on August 11, 2004, following processing and preliminary interpretation. Some geophysical interpretation work remains to be completed in the Site G area. Elevations for Site G should be considered preliminary and subject to change.

2) Bedrock surface elevations are in feet above mean sea level.

Scale (ft)

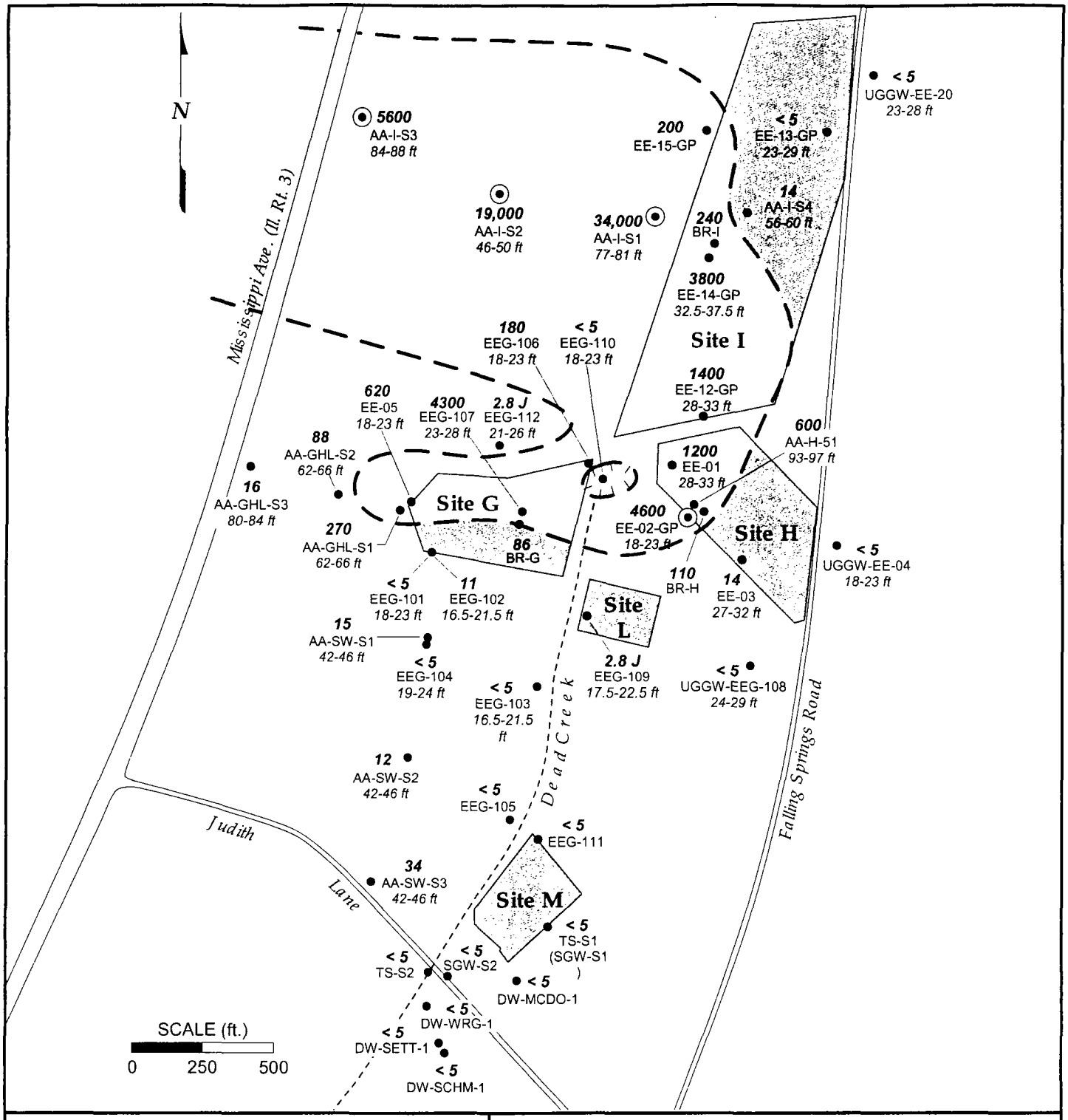
0 200 400

Preliminary Map of Bedrock Surface at Sites G, H, I and L

Sauget Area 1

Sauget and Cahokia, Illinois

G-2876	TJH
08.12.04	JAK
	JAK
As Shown	FIGURE 3



NOTES: 1) Illinois Class I Standard for chlorobenzene: 100 µg/L.

2) Chlorobenzene selected for contouring as it had highest concentration of VOCs at AA-I-S3.

3) Pure phase solubility of chlorobenzene in water is approximately 445,000 µg/L, so 1% of solubility is 4,450 µg/L.

LEGEND

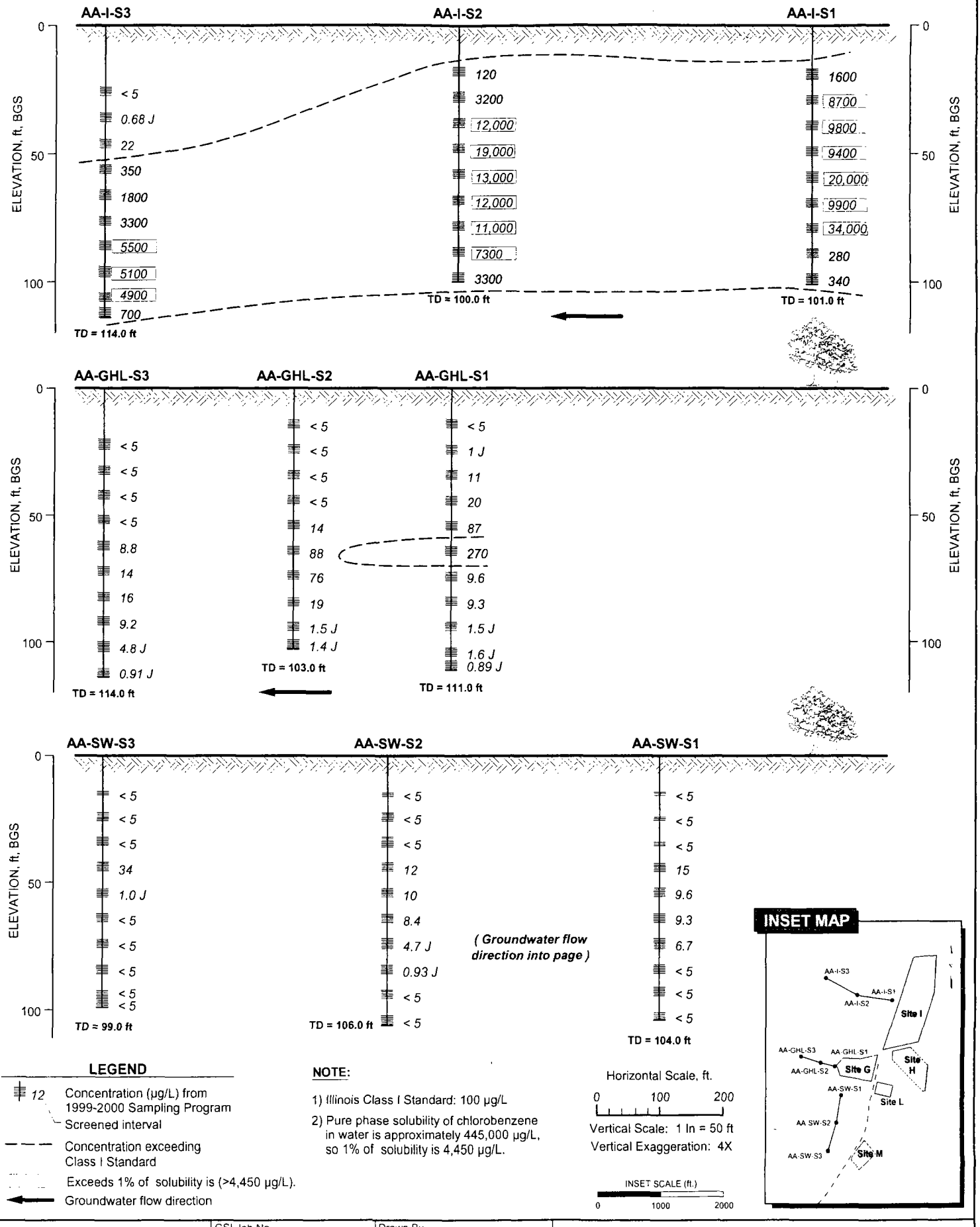
600	Maximum concentration over entire depth interval
•	Sampling locations (µg/L) from 1999-2000 Sampling Program
AA-GHL-S3	Well name
80-84 ft	Depth interval with maximum concentration (ft bgs.)
◯	Exceeds 1% of solubility is (>4,450 µg/L).
— —	Concentration exceeding Class I Standard

GROUNDWATER SERVICES, INC.

GSI Job No.	G-2876	Drawn By:	TUH
Issued	8/11/04	Chk'd By	CJN
Revised:	———	Aprv'd By:	CJN
Scale:	As Shown	**FIGURE 4**	

CHLOROBENZENE CONCENTRATIONS IN GROUNDWATER

Sauget Area 1
Sauget and Cahokia, Illinois



LEGEND

- 12 — Concentration (µg/L) from 1999-2000 Sampling Program
- Screened interval
- Concentration exceeding Class I Standard
- Exceeds 1% of solubility is (>4,450 µg/L).
- Groundwater flow direction

NOTE:

1) Illinois Class I Standard: 100 µg/L

2) Pure phase solubility of chlorobenzene in water is approximately 445,000 µg/L, so 1% of solubility is 4,450 µg/L.

Horizontal Scale, ft.
0 100 200
Vertical Scale: 1 In = 50 ft
Vertical Exaggeration: 4X
INSET SCALE (ft.)
0 1000 2000

INSET MAP

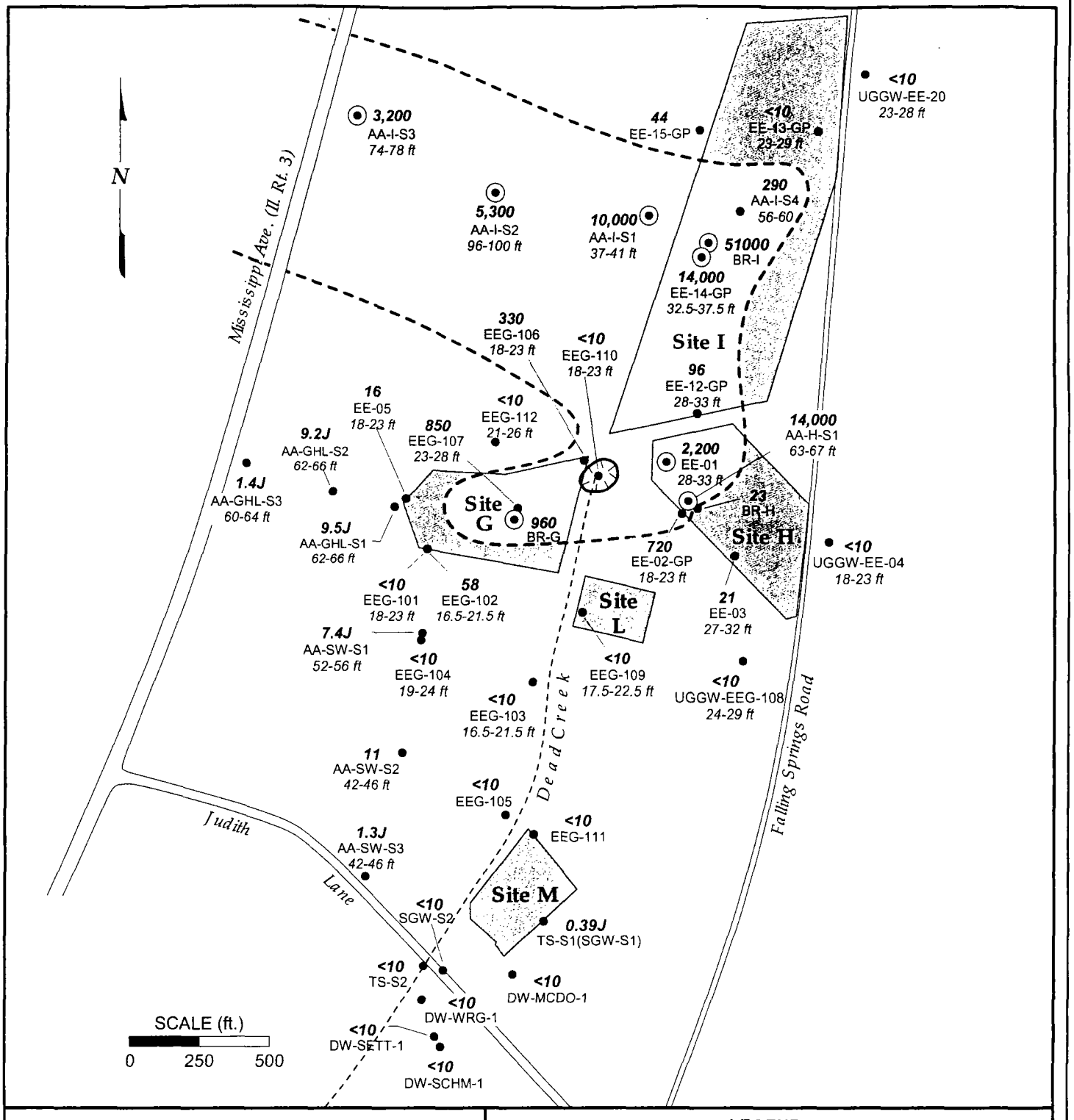
GROUNDWATER SERVICES, INC.

GSI Job No.	G-2876	Drawn By:	TUH
Issued:	8/11/04	Chk'd By:	CJN
Revised:		Aprv'd By:	
Scale:	As Shown		

FIGURE 5

CHLOROBENZENE CONCENTRATIONS VS. DEPTH IN GROUNDWATER

Sauget Area 1
Sauget and Cahokia, Illinois



NOTES: 1) Illinois Class I Standard: 75 µg/L.

2) Pure phase solubility of 1,4 - dichlorobenzene approximately 80,000 µg/L, so 1% of solubility is 800 µg/L.

LEGEND

3.5	Maximum concentration over entire depth interval
•	Sampling locations (µg/L) from 1999-2000 Sampling Program
AA-GHL-S3	Well name
90-94 ft	Depth interval with maximum concentration (ft bgs.)
◯	Exceeds 1% of solubility is (>800 µg/L).
— —	Concentration exceeding Class I Standard

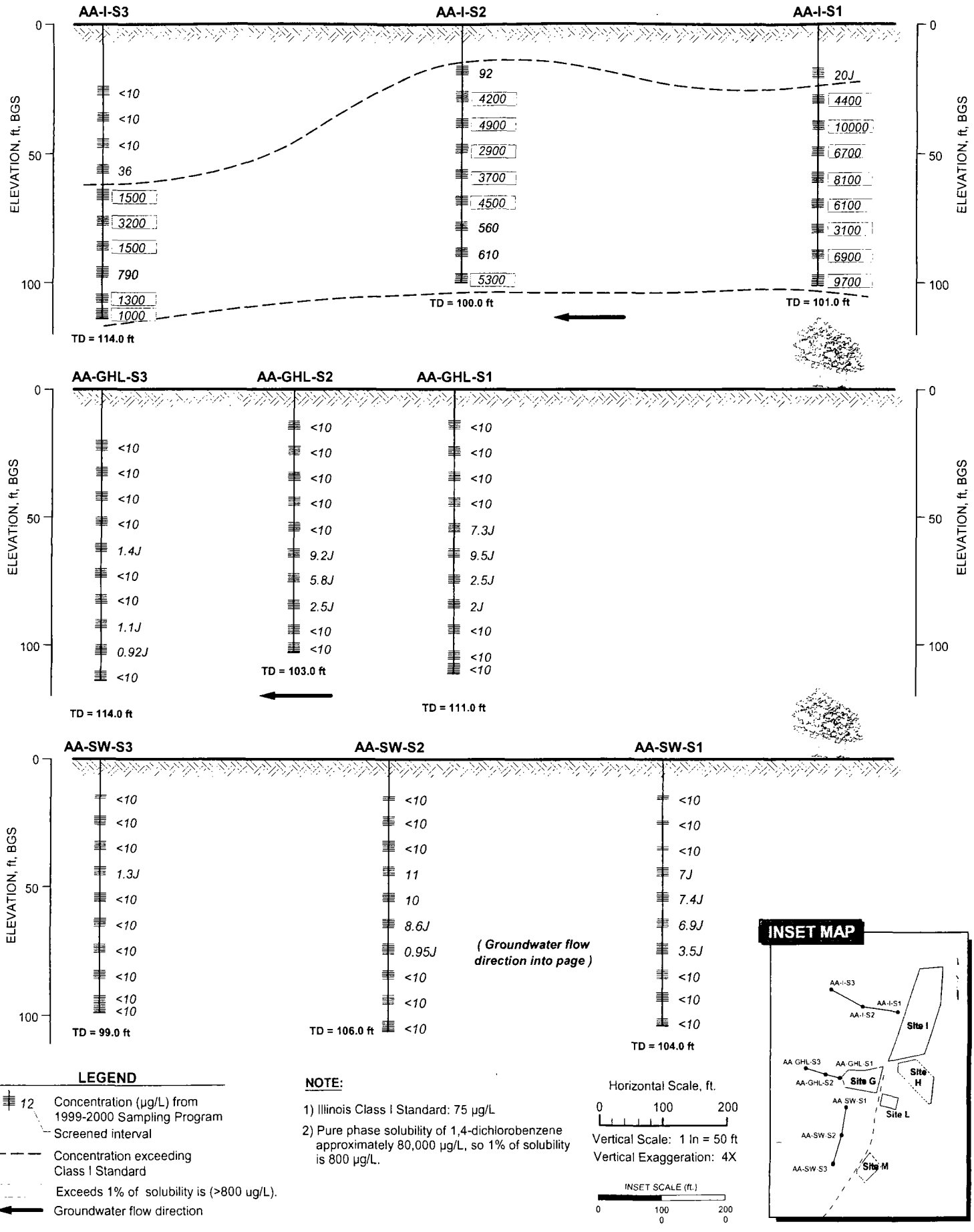
GROUNDWATER SERVICES, INC.

GSI Job No.	G-2876	Drawn By:	TUH
Issued:	8/11/04	Chk'd By:	CJN
Revised:	———	Aprv'd By:	CJN
Scale:	As Shown		FIGURE 6

1,4-DICHLOROBENZENE CONCENTRATIONS IN GROUNDWATER

Sauget Area 1

Sauget and Cahokia, Illinois



GROUNDWATER SERVICES, INC.

GSI Job No.	G-2876	Drawn By:	TUH
Issued:	8/11/04	Chk'd By:	CJN
Revised.		Aprv'd By:	
Scale:	As Shown	FIGURE 7	

1,4-DICHLOROBENZENE CONCENTRATIONS VS. DEPTH IN GROUNDWATER

Sauget Area 1
Sauget and Cahokia, Illinois

N

Note:
Map adapted from aerial photo in "Site Investigation Report, Sauget Site L", Tetra Tech, June 16, 2003.

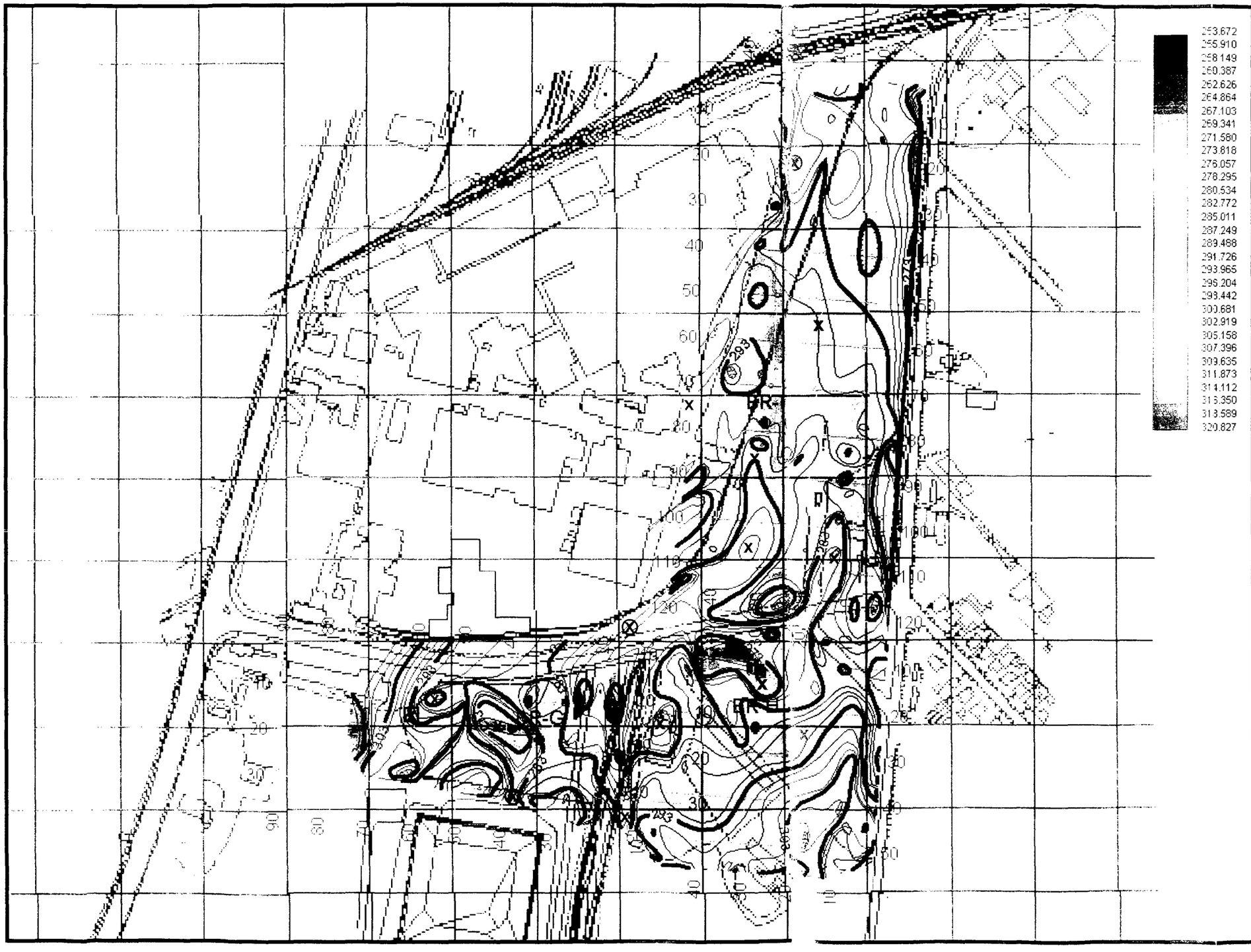
Scale (ft)
0 30 60

GROUNDWATER SERVICES, INC

Map of USEPA Sampling Locations at and Near Site L

Sauget Area 1
Sauget and Cahokia, Illinois

Project No.	G-2876	Designed:	TUH
Issued	08/12/04	Drawn:	JAK
Revised		Approved:	JAK
Scale	As Shown	FIGURE 8	



N

LEGEND

- X — Proposed soil boring/piezometer to bedrock
- ⊗ — Tentative proposed soil boring/piezometer to bedrock
- ☒ — Proposed shallow soil boring/piezometer

Notes:

1) This preliminary bedrock surface map was constructed by a geophysics contractor based on results of a 3-D seismic reflection survey. Seismic survey data was acquired June 7-30, 2004. This map was generated on August 11 2004, following processing and preliminary interpretation. Some geophysical interpretation work remains to be completed in the Site G area. Elevations for Site G should be considered preliminary and subject to change.

2) Bedrock surface elevations are in feet above mean sea level.

Scale (ft)

0 200 400

Proposed Soil Boring/ Piezometer Locations

Sauget Area 1

Sauget and Cahokia, Illinois

G-2976	TJH
08.12.04	JAK
	JAK
As Shown	FIGURE 9